COURSE DATA

DATA SUBJECT

Code: 34939
Name: Power electronics
Cycle: Undergraduate Studies
ECTS Credits: 6
Academic year: 2026-27

STUDY (S)

Degree	Center	Acad. year	Period
1404 - Degree in Industrial Electronic Engineering	Escola Tècnica Superior d'Enginyeria	3	Second quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
1404 - Degree in Industrial Electronic Engineering	Power electronics	COMPULSORY

COORDINATION

EJEA MARTI JUAN BAUTISTA

SUMMARY

This course is compulsory and is provided in the second semester of the third year of the degree in Industrial Electronics Engineering. The total workload is 6 ECTS credits distributed in 2 theoretical credits, 1-credit problems and 3 credits of laboratory.

This course together with the so-called subject electronics Industrial (4th year) forms the power electronics field. In general, the subject of power electronics is the study of devices, circuits, systems and procedures for the processing, control and conversion of electrical energy.

With this concept dealt with systems AC/DC and DC/DC, as the alternatives in the power conversion depending on the nature and electrical characteristics of the primary source of energy and the burden to feed. Throughout the course presents the principles of operation of different topologies which constitute them.

Is a subject that is present in most electronic equipment, so represents a technological support independent of the industrial sector to which we refer.

PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

There are no specified enrollment restrictions with other subjects of the curriculum.

OTHER REQUIREMENTS

The background needed for the subject is acquired in previous courses of the degree. As a subject that covers a particular discipline of electronics, electronic subsystems are analysed from the knowledge of basic analogue electronic devices, the fundamentals of electrical network theory and basic skills of electronic control.

COMPETENCES / LEARNING OUTCOMES

1404 - Degree in Industrial Electronic Engineering

CE4 - Applied knowledge of power electronics.

CG3 - Knowledge of basic and technological subjects that allows students to learn new methods and theories and provides them with versatility to adapt to new situations.

CG4 - Ability to solve problems with initiative, decision-making skills, creativity and critical reasoning and to communicate and transmit knowledge, abilities and skills in the field of industrial engineering (with specific industrial electronics technology).

CG6 - Ability to deal with specifications, regulations and mandatory standards.

DESCRIPTION OF CONTENTS

1. Fundamentals of power electronics

Introduction. Concept of power electronics. Technological evolution and devices used. Energy conversion. Classification. Block diagram of a power converter. Sources and loads of power.

2. Power Electronic Devices

Power switches: diodes, field effect transistors, insulated gate bipolar transistors and thyristors. Static characteristics. Dynamic characteristics.
Resistors and capacitors: characteristics, types and equivalent circuits.

3. AC-DC converters

Rectifiers. Structures P, PD and S. Characteristic parameters. Controlled rectifiers and semi-controlled. Voltage drops. RL and RLE loads.

4. DC-DC Converters

Introduction to regulating the DC-DC converters techniques. Ancillary circuits.
Introduction to DC-DC regulators. Dissipative and non-dissipative. Classification.
Non-isolated switched-mode power converters: Buck, Boost and Buck-Boost topology.

5. Power Electronics Laboratory

Experimental development of different prototypes of power converters:

- Operation of rectifiers non-controlled: RL loads and power diagrams.
- Operation of rectifiers: Full-controlled and Semi-controlled.
- Operation of a Buck DC-DC switched-mode converter: Continuous and discontinuous mode.
- PSIM Simulation of a DC-DC switched-mode converter.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Theory	20,00
Laboratory	30,00
Classroom practices	10,00
Total hours	**60,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	10,00
Independent study and work	30,00
Preparation of lessons	35,00
Preparation for assessment activities	0,00
Resolution of case studies	15,00
Total hours	**90,00**

TEACHING METHODOLOGY

The methodology to employ in the education of this subject develops mainly under the following concepts:

Theory sessions: it understands like Classes of theory the time that passes, usually in a classroom, between the professor and the group of students developing theoretical concepts. During these classes will expose the theoretical foundations that it states the subject, employing different methods that can change in function of the didactic unit (CG3, CG6 and CE4).

Exercises sessions: it understands like exercises classes the time that passes, usually in a classroom, between the professor and the group of students resolving practical exercises. During these classes the students will resolve questions and practical problems with the assistance of the professors. The exchange of ideas between students and interventions is encouraged by proposing common corrections (CG4, CG6 and CE4).

Laboratory sessions: it understands like Classes of laboratory the time that passes in a classroom of laboratory. During these classes the students have of tools of software and electronic material to verify of experimental way the theoretical concepts, as well as the possibility to confirm also the solutions of the exercises (CG3, CG4, CG6 and CE4).

Student's homework: Preparation of the classes, resolution of problems, preparation of works, previous preparation of the sessions of laboratory and preparation of reports

- **Preparation of the classes**: Refers to the individual study to be done by the student before and / or after attending class, as instructed by the teacher. That way he prepares to understand what is going to be explained in it, and to be able to ask questions throughout that class (CG3, CE4).

- **Troubleshooting**: Time used by the student to perform some of the problems proposed by the professor. Some of these problems will be discussed in face-to-face problems sessions (CG4, CG6 and CE4)

- **Preparation of works**: Time that employs the student to make individual works or in-group proposed by the professor (CG3, CG4, CG6 and CE4).

- **Preparation of laboratory sessions and lab-reports**: It corresponds to the time that the students dedicate to understand the practice that they realized in the laboratory, delivering when appropriate, a previous questionnaire. It also includes the time devoted to the report of laboratory practices, once completed (CG3, CG4, CG6 and CE4).

Tutorials

The tutorial have a double aim, by a part, have to serve fundamentally so that the students orient adequately his method of study and, on the other hand, the professor have a feedback method to check the efficiency of the educational method. Also the tutorial will serve for clarify of personalised way doubts of technical character related with any part of the subject. The tutorial will be so much face-to-face as no face-to-face through the platform web "classroom-virtual" (CG4 and CE4).

EVALUATION

ASSESSMENT OF THEORY-PROBLEMS PART (CG3, CG4, CG6, and CE4).

The theory-problems part is assessed continuously and counts for 50% of the final grade for the course. Continuous assessment consists of tests throughout the semester. Two types of tests will be given: CONTROLS and DELIVERABLES.

- CONTROLS (35% of the final grade): Individual written tests. Students will complete a first individual written test throughout the course that will cover Topics 1, 2, and 3. If a student scores 5 out of 10 or higher on this partial test, those topics will be excluded from the final exam during the first call. In the first official call, students who passed the first test will take a second written test on Topic 4 only. The grade for the CONTROLS will be the arithmetic average of the scores obtained in each of the two written tests, provided that both scores are greater than or equal to 5 out of 10. Students who do not pass the first partial test will be required to take an individual written exam covering all course topics during the first official call. To pass this part, the score of this comprehensive written test must be greater than or equal to 5 out of 10, and the result will be considered for the CONTROLS grade. The assessment of this activity can be retaken during the second call if necessary.

- DELIVERABLES (15% of the final grade): These deliverables may include in-person and offline assignments/problems, both group and individual. The grade for the deliverables will be the arithmetic average of the grades obtained for each deliverable, out of the total number of deliverables, considering only those deliverables that obtain a grade of at least 3 points out of 10. Assignments submitted after the established deadline will not be considered for the final grade. This activity cannot be retaken during the second call.

ASSESSMENT OF LABORATORY PART (CG3, CG4, CG6, and CE4).

The laboratory part will be assessed continuously, and the laboratory part counts 50% of the final grade for the course. The continuous assessment grade is composed of two parts:

· 25% corresponds to the reports/assignments for the completed practical sessions (LAB_TASKS).

· 25% corresponds to an individual final exam (EX_LAB).

The grade for the lab reports/assignments will be the arithmetic average of the grades obtained in each report out of the total number of lab practices, considering only lab reports that obtain a grade of at least 3 out of 10. This activity cannot be retaken during the second call.

To pass the lab assessment, a minimum passing grade (5) must be obtained both in the average of the reports/assignments and in the individual final exam.

Attendance at the lab practices is mandatory and necessary to pass the course. Laboratory attendance is a non-recoverable activity. Students are considered to have completed the activity if they have attended at least 80% of the sessions and have adequately justified their inability to attend the remaining sessions due to a force majeure event.

The total grade for the course will be obtained as follows:

GRADE = 0.35xCONTROLS + 0.15xDELIVERABLES + 0.25xLAB_TASKS + 0.25xEX_LAB

To obtain the weighted average for the different grades, a minimum score of 5 out of 10 must be obtained on each of the written tests in the theory-problems part, the laboratory reports/assignments, and the individual final laboratory exam.

Students who do not pass the course in the first call will have the opportunity to recover the grades corresponding to the CONTROLS (35% of the final grade) and the FINAL EXAM for the laboratory part (25%) in the final exam of the second call.

In any case, the evaluation system will be governed by the guidelines set forth in the Evaluation and Grading Regulations of the University of València for Bachelor's and Master's degrees.

(https://webges.uv.es/uvTaeWeb/MuestraInformacionEdictoPublicoFrontAction.do?accion=inicio&idEdictoSeleccionado=5639)

Copying or plagiarism of any activity that is part of the evaluation will result in the impossibility of passing the course, and the student will then be subject to the appropriate disciplinary procedures indicated in the ACTION PROTOCOL FOR FRAUDULENT PRACTICES AT THE UNIVERSITY OF VALENCIA (ACGUV 123/2020).

REFERENCES

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